

CLAIMS:

1. A reflective liquid-crystal display, comprising:

a reflective liquid-crystal panel;

a light guiding plate disposed on said reflective liquid-crystal panel;

5 a polarizer disposed between said reflective liquid-crystal panel and said light guiding plate; and

a light source disposed on a side surface of said light guiding plate,

wherein:

light emitted from said light source propagates through said light

10 guiding plate, the light having a primary direction; and

a smaller one of two angles between a projection of the primary direction onto said reflective liquid-crystal panel and an absorption axis of said light guiding plate is at least 50°.

2. A reflective liquid-crystal display, comprising:

15 a reflective liquid-crystal panel;

a light guiding plate disposed on said reflective liquid-crystal panel;

a polarizer disposed between said reflective liquid-crystal panel and said light guiding plate;

a light source disposed on a side surface of said light guiding plate,

20 wherein:

light emitted from said light source propagates through said light guiding plate and is emitted from said light guiding plate toward said polarizer, the light having a primary direction; and

a smaller one of two angles between a projection of the primary direction onto said reflective liquid-crystal panel and an absorption axis of said light guiding plate is more than 0° and at most 40°.

25

3. A reflective liquid-crystal display, comprising:

a reflective liquid-crystal panel;

a light guiding plate disposed on said reflective liquid-crystal panel;

a polarizer disposed between said reflective liquid-crystal panel and

5 said light guiding plate; and

a light source disposed on a side surface of said light guiding plate,

wherein:

light emitted from said light source propagates through said light  
guiding plate, the light including primary polarized light; and

10 a smaller one of two angles between a projection of a direction of the  
primary polarized light onto said reflective liquid-crystal panel and an  
absorption axis of said light guiding plate is at least 50°.

4. A reflective liquid-crystal display, comprising:

a reflective liquid-crystal panel;

15 a light guiding plate disposed on said reflective liquid-crystal panel;

a polarizer disposed between said reflective liquid-crystal panel and

said light guiding plate;

a light source disposed on a side surface of said light guiding plate,

wherein:

20 light incident to said reflective liquid-crystal panel has primary  
polarized light; and

a smaller one of two angles between a projection of a direction of the  
primary polarized light onto said reflective liquid-crystal panel and an  
absorption axis of said light guiding plate is at least 50°.

25 5. A reflective liquid-crystal display according to claim 3, wherein said primary  
polarized light is p-polarized light or s-polarized light.

6. A reflective liquid-crystal display according to claim 4, wherein said primary polarized light is p-polarized light or s-polarized light.

7. A reflective liquid-crystal display according to claim 1, wherein said light guiding plate is inclined with respect to said liquid crystal panel, distance

5 between said light guiding plate and a surface of said liquid crystal panel increasing as distance between said light guiding plate and said light source decreases.

8. A reflective liquid-crystal display according to claim 2, wherein said light guiding plate is inclined with respect to said liquid crystal panel, distance

10 between said light guiding plate and a surface of said liquid crystal panel increasing as distance between said light guiding plate and said light source decreases.

9. A reflective liquid-crystal display according to claim 3, wherein said light guiding plate is inclined with respect to said liquid crystal panel, distance

15 between said light guiding plate and a surface of said liquid crystal panel increasing as distance between said light guiding plate and said light source decreases.

10. A reflective liquid-crystal display according to claim 4, wherein said light guiding plate is inclined with respect to said liquid crystal panel, distance

20 between said light guiding plate and a surface of said liquid crystal panel increasing as distance between said light guiding plate and said light source decreases.

11. A reflective liquid-crystal display according to claim 1, further comprising a retardation layer between said light guiding plate and said polarizer, wherein

25 said retardation layer has an optical axis arranged between said smaller one of two angles between said projection and said absorption axis and  $90^\circ$ .

12. A reflective liquid-crystal display according to claim 2, further comprising a retardation layer between said light guiding plate and said polarizer, wherein said retardation layer has an optical axis arranged between said smaller one of two angles between said projection and said absorption axis and  $90^\circ$ .
- 5 13. A reflective liquid-crystal display according to claim 3, further comprising a retardation layer between said light guiding plate and said polarizer, wherein said retardation layer has an optical axis arranged between said smaller one of two angles between said projection and said absorption axis and  $90^\circ$ .
14. A reflective liquid-crystal display according to claim 4, further comprising
- 10 a retardation layer between said light guiding plate and said polarizer, wherein said retardation layer has an optical axis arranged between said smaller one of two angles between said projection and said absorption axis and  $90^\circ$ .
15. A reflective liquid-crystal display according to claim 11, wherein said retardation layers have retardation adjusted to from 200 nm to 400 nm.
- 15 16. A lighting apparatus, comprising:
- a light guiding plate; and
  - a light source disposed on a side surface of said light guiding plate,
- wherein
- said light guiding plate has a flat first surface having a plurality of
- 20 projections,
- each said projection is formed with a first inclined plane having a first angle between said plane and said flat first surface and a second inclined plane formed adjacent to said first inclined plane with a second angle between said plane and said flat first surface, said second angle being larger than said first
- 25 angle, said lighting apparatus further comprising
- a light preventive layer preventing light from passing therethrough on

each said second inclined plane.

17. A reflective liquid-crystal display according to claim 16, further comprising  
a low-refractive-index layer formed between said light preventive layer  
on said second inclined plane and said second inclined plane, said

5 low-refractive-index layer having a refractive index smaller than a refractive  
index of said light guiding plate.

18. A reflective liquid-crystal display according to claim 16, wherein said light  
preventive layer is a layer to reflect light.

19. A reflective liquid-crystal display according to claim 17, wherein said light  
10 preventive layer is a layer to reflect light.

20. A reflective liquid-crystal display according to claim 18, wherein said light  
preventive layer is a layer to absorb light.

21. A reflective liquid-crystal display according to claim 16, wherein said light  
preventive layer includes a light reflection layer on said second inclined surface  
15 and a light absorption layer formed thereon.

22. A reflective liquid-crystal display, comprising:  
a lighting apparatus, comprising

a light guiding plate including a flat first surface having a  
plurality of projections, each said projection being formed with a first inclined  
20 plane having a first angle between said plane and said flat first surface and  
with a second inclined plane formed adjacent to said first inclined plane with a  
second angle between said plane and said flat first surface, said second angle  
being larger than said first angle and

a light source disposed on a side surface of said light guiding  
25 plate;

a reflective liquid-crystal panel disposed on a second surface of said

light guiding plate, said second surface opposing said first surface, said reflective liquid-crystal panel opposing said first surface;

a polarizer disposed between said reflective liquid-crystal panel and said light guiding plate; and

5 a low-refractive-index layer formed between said polarizer and said light guiding plate, said low-refractive-index layer having a refractive index smaller than a refractive index of said light guiding plate.

23. A reflective liquid-crystal display according to claim 17, wherein said low-refractive-index layer is formed using a fluorine-based resin or a  
10 fluorine-based liquid.

24. A reflective liquid-crystal display according to claim 22, wherein said low-refractive-index layer is formed using a fluorine-based resin or a fluorine-based liquid.

25. A reflective liquid-crystal display, comprising:

15 a transparent first substrate;  
a first electrode formed on said first substrate;  
a second substrate having a light absorbing function;  
a second electrode formed on said second substrate;  
a uniform-refractive-index layer formed on said first electrode in a state  
20 in which said first and second substrates are arranged with said first and second electrodes being opposing each other, said uniform-refractive-index layer including a surface having projections and depressions, said uniform-refractive-index layer having a substantially uniform refractive index;  
a liquid-crystal layer sandwiched between said first and second  
25 substrates, said liquid-crystal layer forming a boundary plane between said liquid-crystal layer and said uniform-refractive-index layer; and

voltage applying means for applying voltages to said first and second electrodes, wherein

said projections and depressions of the boundary plane has an amplitude H and a pitch P, said amplitude H being at least 0.5 time of the pitch

5 P.

26. A reflective liquid-crystal display according to claim 25, wherein said liquid-crystal layer includes a polymer-dispersion-type liquid crystal (PDLC), said PDLC including macromolecules and liquid-crystal clusters dispersed therein, each said cluster including a large number of liquid-crystal molecules.

10 27. A reflective liquid-crystal display according to claim 25, wherein said uniform-refractive-index layer has refractive index anisotropy substantially equal to refractive index anisotropy of said liquid-crystal molecules of said aligned liquid-crystal clusters.

28. A reflective liquid-crystal display according to claim 25, further comprising  
15 a lighting apparatus disposed in the neighborhood of said first substrate.

29. A lighting apparatus, comprising:

a planar member, comprising

a transparent first electrode,

a uniform-refractive-index layer formed on said first electrode,

20 said uniform-refractive-index layer including a surface having projections and depressions, said uniform-refractive-index layer having a substantially uniform refractive index,

a scattering liquid-crystal layer formed on said

uniform-refractive-index layer, said scattering liquid-crystal layer forming a

25 boundary plane between said scattering liquid-crystal layer and said

uniform-refractive-index layer, said scattering liquid-crystal layer being capable

of changing a scattering characteristic thereof by changing an applied voltage applied thereto,

a second electrode formed on said scattering liquid-crystal layer; and

5 a light-emitting device disposed on an end section of said planar member.

30. A lighting apparatus according to claim 29, wherein at least either one of said first and second electrodes comprises a plurality of linear electrodes arranged in parallel to each other, wherein

10 said voltage applying means includes a selecting circuit for sequentially selecting either one of said linear electrodes and for preventing a voltage from being applied thereto.

31. A lighting apparatus according to claim 30, further comprising a low-refractive-index layer formed between said first electrode and said

15 scattering liquid-crystal layer  
or between said first electrode and said uniform-refractive-index layer, said low-refractive-index layer having a refractive index lower than that of said uniform-refractive-index layer.

32. A liquid-crystal display, comprising:

20 a liquid-crystal panel, comprising

a transparent first substrate,

a transparent first electrode formed on said first substrate,

a uniform-refractive-index layer formed on said first electrode,

said uniform-refractive-index layer including a surface having projections and

25 depressions, said uniform-refractive-index layer having a substantially uniform refractive index,



a scattering liquid-crystal layer formed on said uniform-refractive-index layer, said scattering liquid-crystal layer forming a boundary plane between said scattering liquid-crystal layer and said uniform-refractive-index layer, said scattering liquid-crystal layer being capable  
5 of changing a scattering characteristic thereof by changing an applied voltage applied thereto,

a second substrate,

a second electrode formed on said second substrate, said second electrode being in contact with said scattering liquid-crystal layer, and  
10 voltage applying means for applying voltages to said first and second electrodes,

either one of said first and second electrodes being partitioned for each pixel area;

a planar member disposed opposing said liquid-crystal panel; and

15 a lighting apparatus comprising a light emitting device at an end section of said planar member.

33. A liquid-crystal display according to claim 32, further comprising a low-refractive-index layer formed between said first electrode and said scattering liquid-crystal layer

20 or between said first electrode and said uniform-refractive-index layer, said low-refractive-index layer having a refractive index lower than that of said uniform-refractive-index layer.